as used are only indications of direction and give no estimate of velocity.

From the standpoint of air line operation in the future with airplanes built to fly through heavy weather, operation will depend only upon two things, terminal conditions and the upper wind distribution.

It is hoped that by using a wind scale such as here described, upper wind forecasting will be put on more of a uniform basis.

CONCLUSIONS

1. Upper wind charts using streamlines which are tangent to the wind arrows and spaced according to the velocity give a clearer picture of the wind conditions aloft than charts using only wind arrows.

2. The isobars on the present weather map are used because they indicate the direction and velocity of the wind. Unless the meteorologist considers the change in pressure for rapidly moving pressure systems the winds computed from the isobars give only the conditions for a stationary system.

If instead of trying to deduce the wind velocities from something more or less intangible, wind direction and velocity are used directly, fewer errors are apt to arise.

3. A geostrophic wind scale may be laid out to aid in the construction of an upper-air streamline map.

AIR MASSES OF SOUTHERN BRAZIL

By ADALBERTO SERRA and LEANDRO RATISBONNA

[Departmento de Aeronáutica Civil, Rio de Janeiro, Brazil, October 1937]

From preliminary studies made on the atmospheric circulation of South America, the principal air masses that pass over Rio de Janeiro and Alegrete have been found to be the following:

Polar maritime (PM)—Polar maritime air masses originate in the region of the belt of low pressures or "brave west winds" of the Antarctic circle. They appear south of Brazil as anticyclones, which upon coming in contact with the tropical air masses form cold fronts along which storms develop.

In winter, in Alegrete, these masses are convectively unstable. They have low values of temperature and relative humidity because they are moving over regions which are warm relative to the source. These air masses frequently reach Rio de Janeiro but due to the accompanying bad weather, soundings are not practicable.

In summer, despite an increase in values of w and θ_e, the winter characteristics persist at Alegrete. In Rio de Janeiro, however, the relative humidity is at a maximum, as a result of abundant rainfall at cold front passages; the other characteristics remain unchanged.

The pronounced increase in the characteristic values at Rio de Janeiro over those observed at Alegrete should be noted. In general, stratification is not very marked, but rather a tendency to homogeneity is evident.

Modified polar maritime (NPM)—In proceeding to lower latitudes, the polar air decreases in velocity, and a modification takes place which is characterized by subsidence, decrease in cloudiness, and a gradual fusion with the tropical Atlantic air.

This modification is manifest in winter in Alegrete through the increase in characteristic values, greater stability at low levels, more pronounced stratification, surface temperature inversions, and decrease in relative humidity.

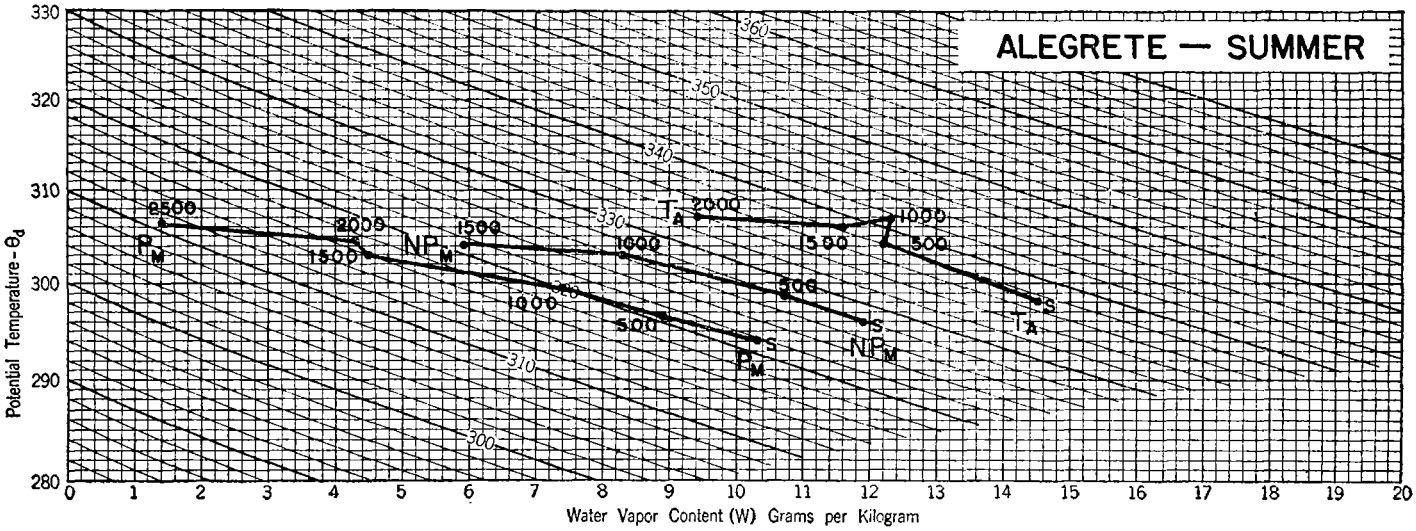

FIGURE 1.—Characteristic curves of air masses at Alegrete during summer.

In summer the ordinarily high instability of the season at Alegrete hinders subsidence. In Rio de Janeiro, however, there is little difference between PM and NPM, although the latter air masses do have lower relative humidity values.

Tropical Atlantic (TA)—Tropical Atlantic air masses originate in the center of action of the south Atlantic and are transported by NE, N, and NW winds.

In winter these masses prevail at Rio de Janeiro (situated near the source region), almost exclusively. They show great instability at the surface, due to local heating, and small lapse rates. On account of their maritime origin they have high relative humidities.

These masses reach Alegrete after a long trajectory, and a gradual cooling can be noticed in the lower levels with a consequent increase in stability indicated by a surface inversion. Relative humidity remains high as a result of the lower temperature.

In summer, in Rio de Janeiro, stratification and instability are both pronounced, but the relative humidity, although high throughout the lower levels, decreases with

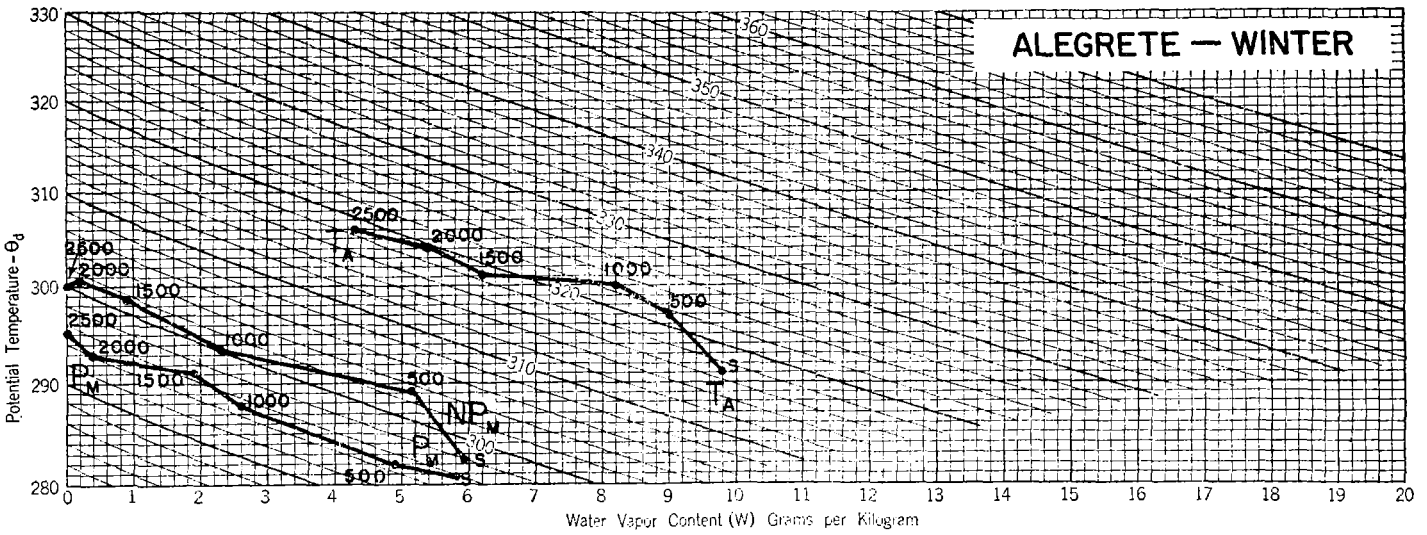

FIGURE 2.—Characteristic curves of air masses at Alegrete during winter.

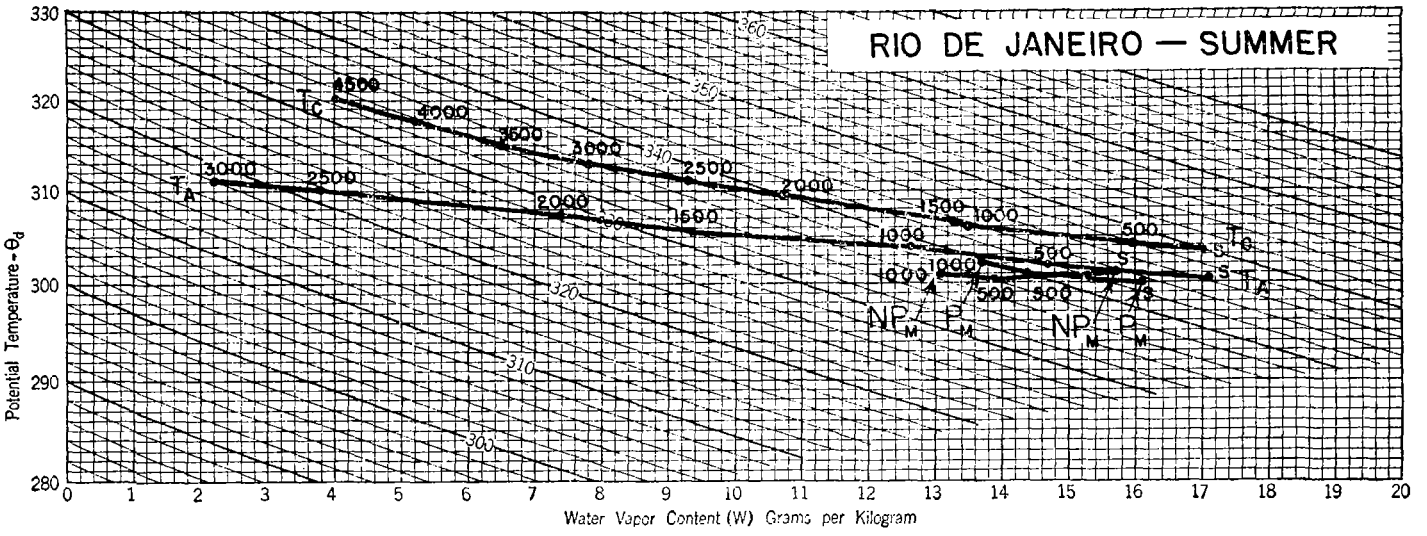

FIGURE 3.—Characteristic curves of air masses at Rio de Janeiro during summer.

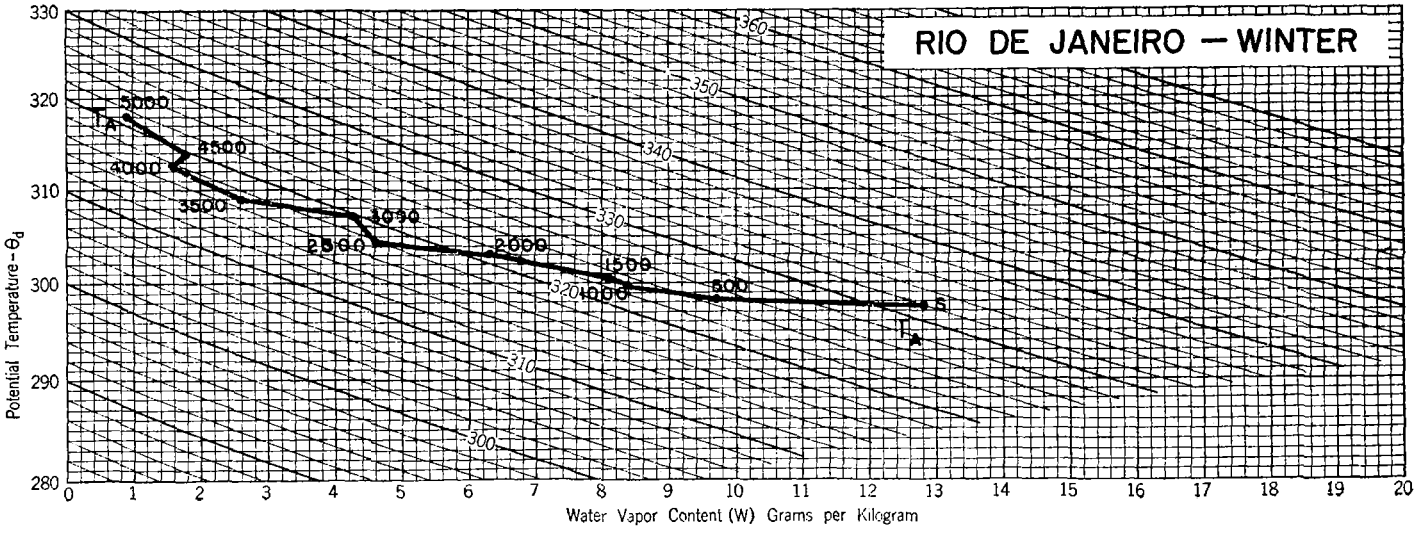

FIGURE 4.—Characteristic curves of tropical Atlantic air masses at Rio de Janeiro during winter.

altitude. The discontinuity at 1,000 meters implies the passage of an air mass aloft of doubtful origin.

Tropical continental (Tc)—These air masses have their source over the vast continental forest; the trajectory of

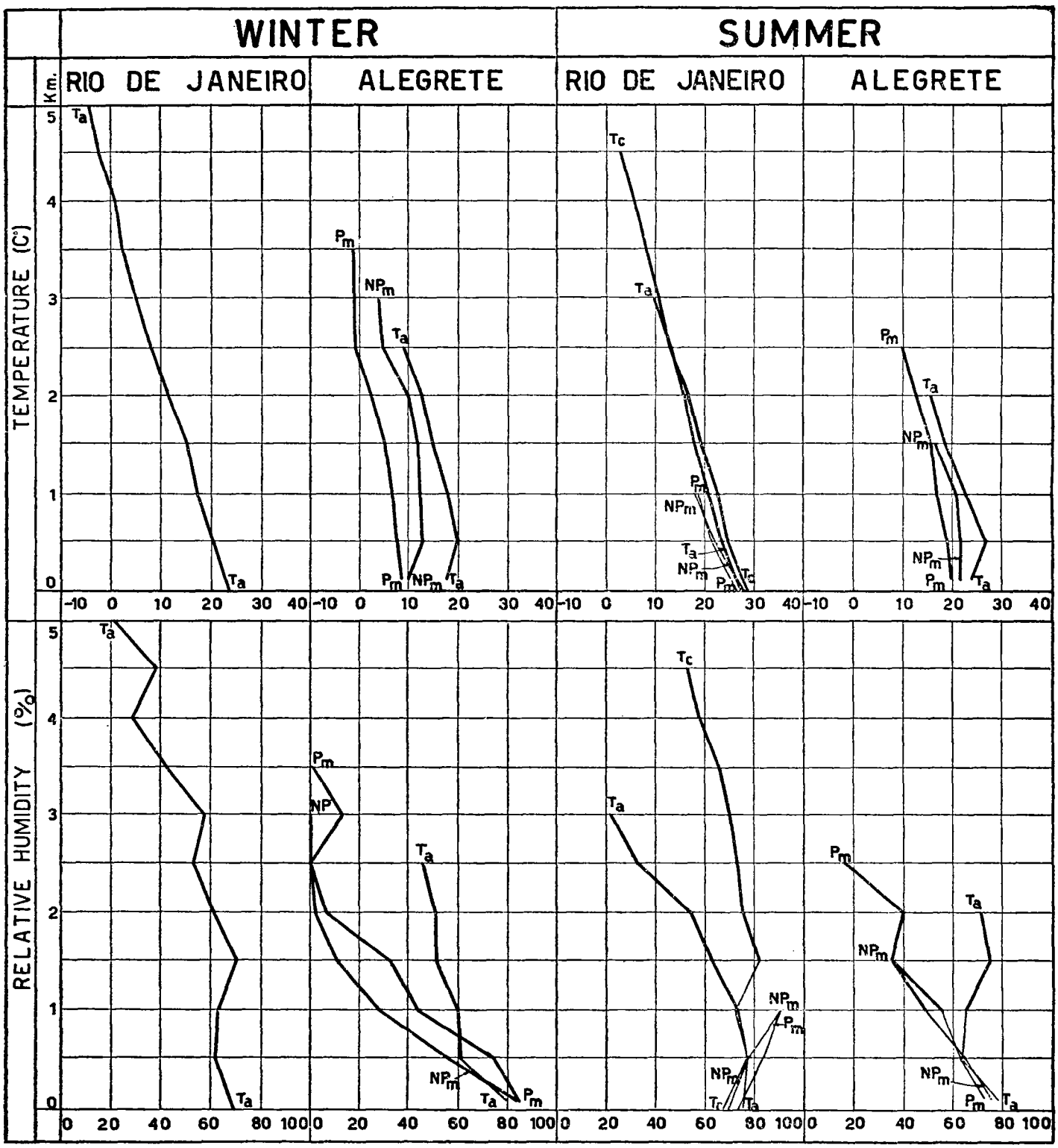

FIGURE 5.—Upper-air temperature and humidity values for winter and summer at Rio de Janeiro and Alegrete.

Tc masses extends to the latitude of Rio de Janeiro in summer only. They are characterized by convective instability, high temperature, and high relative humidity.

In the accompanying tables and charts, attention is directed to the great similarity existing between the values of w and θ_E found in the air masses of Brazil and those found in the corresponding ones of North America, noted by Willett. The indications are, therefore, that the modern methods of frontological theory are applicable in subtropical zones for making short period weather forecasts.

Future notes will be added to the present data, as soon as more details of South American air masses are available.